

# The Environmental History and Current Characteristics of Gloucester Harbor

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## ABSTRACT

Gloucester Harbor is known for its prolific fishing industry and currently supports a range of fisheries and maritime businesses. Through the 400-year history of the development of this protected embayment of Cape Ann into a productive maritime port, Gloucester Harbor has endured dramatic economic, social, and physical changes. This report identifies discrete development periods to chronologically characterize economic and social development, physical alteration of the harbor shoreline and waters, progression of public and environmental policy, and changes in human influences. Gloucester Harbor has an interesting history that reflects the development of a nation and remains a key asset to current and future maritime industry of the Commonwealth of Massachusetts.

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## INTRODUCTION

Gloucester, Massachusetts is known as a prolific fishing port, and the historic abundance of fishery resources found in the coastal waters of Cape Ann greatly contributed to the colonization of New England. Cape Ann has a rugged coastline characterized by rocky shores, sandy beaches, and protected embayments. Gloucester Harbor is located on the eastern shore of Cape Ann in a natural embayment. The natural harbor and productive, nearshore fishing grounds were essential and defining characteristics of the development of Gloucester Harbor.

Gloucester's natural resources sustained populations of indigenous Americans before European settlement. Agawam tribes inhabited Gloucester, cultivated land for agriculture, and harvested fish and shellfish. When European explorers discovered the abundant fishery resources of Cape Ann waters, they recognized the need for a harbor. The protected embayment and rich fishing grounds provided the fundamental elements to develop Gloucester into a productive maritime port. The four hundred year

history of Gloucester Harbor, including the marine resources and environmental quality of harbor waters, reflects an evolving economy, advances in technology, and transition of public policy.

The economy and society of Gloucester was directly or indirectly dependent on fishery resources from the 1600s to 1900s. Technological advances in the 19<sup>th</sup> and 20<sup>th</sup> centuries, such as seafloor dredging, refrigeration, and railroad transportation, stimulated the industrialization of Gloucester's waterfront and diversified the economy. Shoreline structures were built to accommodate the use of the waterway for transportation, trade, and fishing industries. Properties were extended seaward to reach navigable waters. Public works projects, such as the construction of the Blynman Canal (1600s), deep navigation channels (1800s), and Dog Bar Breakwater (1904), aimed to enhance the safety and utility of Gloucester Harbor. These projects altered coastal, intertidal, and submerged habitats and redefined the shoreline.

Population was stable during initial European colonization and dramatically increased with the

industrialization of Gloucester in the late 1800s. Direct manipulations to the harbor were coupled with impacts from waste disposal. Sewage, fish processing by-products, and toxic materials associated with maritime businesses were largely unregulated and polluted waterways for over two centuries. Industrialization and centuries of resource exploitation resulted in cumulative degradation of the marine environment.

Public opinion and environmental policy shifted in the 1970s. The transition in policy was fueled by the understanding of natural systems and risks to human health associated with pollution. The passage of the Water Pollution Control Act amendments in 1972 (Clean Water Act) demonstrated recognition of waterways for their ecological and economic values, and public investment turned to pollution abatement. Public policy and resource management strategies sought to reclaim environmental quality and balance economic and ecological values. Environmental conditions rebounded from a period of extreme degradation at the height of unregulated maritime industrial activity and waste disposal to a point that water and sediment quality problems and related human health risks appear to be restricted to specific harbor locations. Environmental issues currently remain to be evaluated and addressed, including combined sewer overflows, stormwater, fuel spills, vessel discharge, contaminated seafloor sediments, invasive species, and sea level rise.

The objective of this report is to trace the history of harbor development and describe current characteristics in Gloucester Harbor. To achieve this objective, development time periods are identified to chronologically characterize economic and social development, physical alteration of the harbor shoreline and waters, progression of public and environmental policy, and changes in human influences.

## **HISTORICAL CONTEXT**

The history of Gloucester Harbor parallels the development of the Northwest Atlantic fisheries and reflects United States industrialization. Economic development, urbanization, technological advances, and maturation of public policy influenced the harbor environment. Three periods of development were

identified: (1) colonial settlement and establishment of the port, 1623-1850; (2) early industrialization and fisheries dominance, 1850-1920; and (3) modernization and transition, 1920-2000.

### **Colonial Settlement and Establishment of the Port (1623-1850)**

Abundant inshore fisheries stimulated early English settlement of Cape Ann. Limited agricultural prospects, rich marine resources, harbor physical features, and the importance of waterways for moving people and goods led to the development of Gloucester's waterfront. Gloucester Harbor became an international trading center. Changes in technology and trade policy pushed the port to fully turn to the fishing industry as stimulus for the local economy by the mid-1800s.

#### **Social and Economic Development**

French explorer Samuel Champlain landed in Gloucester Harbor in 1606, and English settlers from Dorchester returned in 1623 to establish the first permanent fishing station in the Massachusetts Bay Colony (Pringle 1892). Before the English settlement, a community of Agawams—tribe of the Algonquin—lived in a village along the Gloucester shoreline. The Agawam village contained cleared land used for cultivating corn, and fish and shellfish harvest was important (Pringle 1892). Plagues eliminated the native population by the 1620s. Small colonial villages were well established on Gloucester Harbor, the Annisquam River, and the north side of Cape Ann on Ipswich Bay by the 1640s (Pringle 1892).

Local fishery resources supported community growth, and soil was sufficient to support subsistence farming and grazing. Fishing Cape Ann waters was very productive, provided fresh food supply to early settlers, and sustained an important foreign trade (Howe 1969). Timber was an important natural resource for home construction and shipbuilding in Gloucester and supported a timber trade with neighboring colonies (Boston and Salem). The timber industry was short-lived because concern that woodlands were being depleted led the community to pass laws limiting wood cutting for export (Pringle 1892).

By 1700, Gloucester's population was approximately

650. Fishing and farming were equally important for supplying local needs (Pringle 1892). Fishermen gradually fished offshore waters as coastal resources were depleted, and fishing vessels were fishing as far east as Cape Sable in 1711 (Howe 1969). The first two-masted schooner of the English colony was built in Gloucester in 1713. The schooner design dominated the vessels of offshore fisheries for close to 200 years (Matchak 1989). Population growth and coastal development was concentrated around the harbor by 1750, with the population expanding to 2,700. Large boats fished, primarily for cod, as far out as the Grand Banks (Pringle 1892). The inshore mackerel fishery became important in the 1830s, and salt cod was a lucrative commodity for trade with Europe, the West Indies, and Surinam (Matchak 1989).

International trade and supporting industries (e.g., fishing, shipbuilding, and brokering) was the foundation of Gloucester's economy after the Revolutionary War, until the 1840s. Trade laws and taxation policies, during the 1840s, forced Gloucester merchants to funnel exports through Boston to import foreign goods. These changes stimulated a shift from foreign trade to the already-successful fisheries as the center of the Gloucester economy (Matchak 1989).

Two technological changes in the 1840s and 1850s revolutionized the fishing industry. The railroad was extended north from Boston to Gloucester in 1846, providing direct and efficient access for fish landed in Gloucester to New England. Refrigeration was introduced in the 1850s, and vessels began targeting new species, such as halibut and haddock, that were suitable for freezing rather than salting (Matchak 1989). The expansion of the fresh fish market supplemented the prosperous salt cod industry.

Rail transportation also brought visitors to Gloucester for summer retreat and recreation, leading to hotel development on the outer harbor and summer estates at Eastern Point. The natural beauty of Cape Ann attracted artists and writers to Gloucester's waterfront to establish the first art colony in America on Rocky Neck (Pringle 1892).

*Physical Changes and Shoreline Development*  
Natural features and geographic location of Gloucester were key to the city's initial growth as a center for

maritime trade and its dominance as a fishing port in the mid-to-late 1800s. In addition to a deep water and sheltered harbor, Gloucester had an important geographic advantage over Boston in the days of sail. Cape Ann was closer to the principle fishing grounds, and vessels could avoid sailing against the typical westerly winds encountered on route to Boston (National Park Service 1994).

Fishing vessels and other craft needed a protected and shorter route between the harbor and Ipswich Bay. Reverend Blynman, a religious and political leader of the time, received permission in 1642 to dig a canal between the harbor and Annisquam River. Referred to as "the Cut" and later called the Blynman Canal, the passage was periodically filled in over the years due to storms and was intentionally filled after periods of disuse (Babson 1860). By the late 1800s, the canal was ultimately maintained as a permanent maritime highway.

Shoreline construction initially included filling, wharfs, piers, docks, and cobbs (i.e., log-cabin-like wooden frames filled with refuse, rubble, and soil). Stone seawalls and docks on piles were constructed, but solid fill was the preferred method of coastal development (Matchak 1989). Inner harbor water depth around Harbor Cove was 20 feet at low tide. Initial development was concentrated in Harbor Cove, which was the center of maritime commerce on Gloucester Harbor until about 1830. Vincent's Cove and areas around the Head of the Harbor (northeast portion of the inner harbor) were relatively shallow and eventually were sites of substantial filling (Matchak 1989). Present-day Rogers Street did not exist, and Main Street (then Front Street) was the waterfront road.

In 1836, 274 large vessels and hundreds of smaller boats were berthed in Gloucester (Matchak 1989). The fishing vessels primarily targeted mackerel and cod (Howe 1969; Matchak 1989). The waterfront supported hundreds of wooden buildings and acres of fish flakes, that is, racks for drying and salting fish fillets. As ship size and tonnage increased, new shoreline and harbor construction was required to access adequate water depth (Matchak 1989). Filling allowed access to deeper waters and expanded the shore-side area available to support the working waterfront. The following 50 years (1850-1900) of

harbor development was characterized by substantial harbor growth with extensive filling and shoreline development (Matchak 1989) that permanently reshaped the waterfront of Gloucester Harbor.

### **Early Industrialization & Dominance of the Fisheries: 1850 – 1920**

The urbanization of Gloucester occurred between the late 1800s and early 1900s, characterized by rapid population growth, economic prosperity, and diversification of maritime businesses related to the fishing industry. Technological advances encouraged large-scale change to the harbor for industrial needs. Harbor development was supported by public policy and public works projects. Fisheries and maritime trade remained important, but Gloucester's geographic advantage over Boston was diminished with the invention of steam- and diesel-powered vessels. Nevertheless, the well-developed harbor economy weathered several recessions and continued to prosper as a productive New England port.

#### **Social and Economic Development**

Productive fisheries encouraged substantial emigration of skilled labor from the Canadian Maritimes, Portugal, and Ireland, and Gloucester's population grew to 10,000 by 1860. By the time Gloucester was incorporated as a city in 1873, the number of residents increased to approximately 16,000 (Pringle 1872). Gloucester was a full-service port by the end of the Civil War (1865), with a high concentration of maritime labor, vessel service, and supply operations. Tarr and Wonson Paint Factory was established on Rocky Neck (1863). The paint factory was the first copper paint factory in the country and supplied anti-fouling bottom paints for vessels throughout the northeastern United States. Cape Ann Anchorworks, Gloucester Net & Twine, and Gloucester Marine Railway started operation in the 1880s (National Park Service 1994).

Gloucester was the fishing center of North America in the 1870s and 1880s, setting fish prices for the region. Until early 20<sup>th</sup> century, the most efficient method for moving fish from Gulf of Maine fishing grounds to the growing inland U.S. population was by sailing to Gloucester, unloading the catch, and transporting the catch by train to Boston (National Park Service 1994). The prosperity of Gloucester's

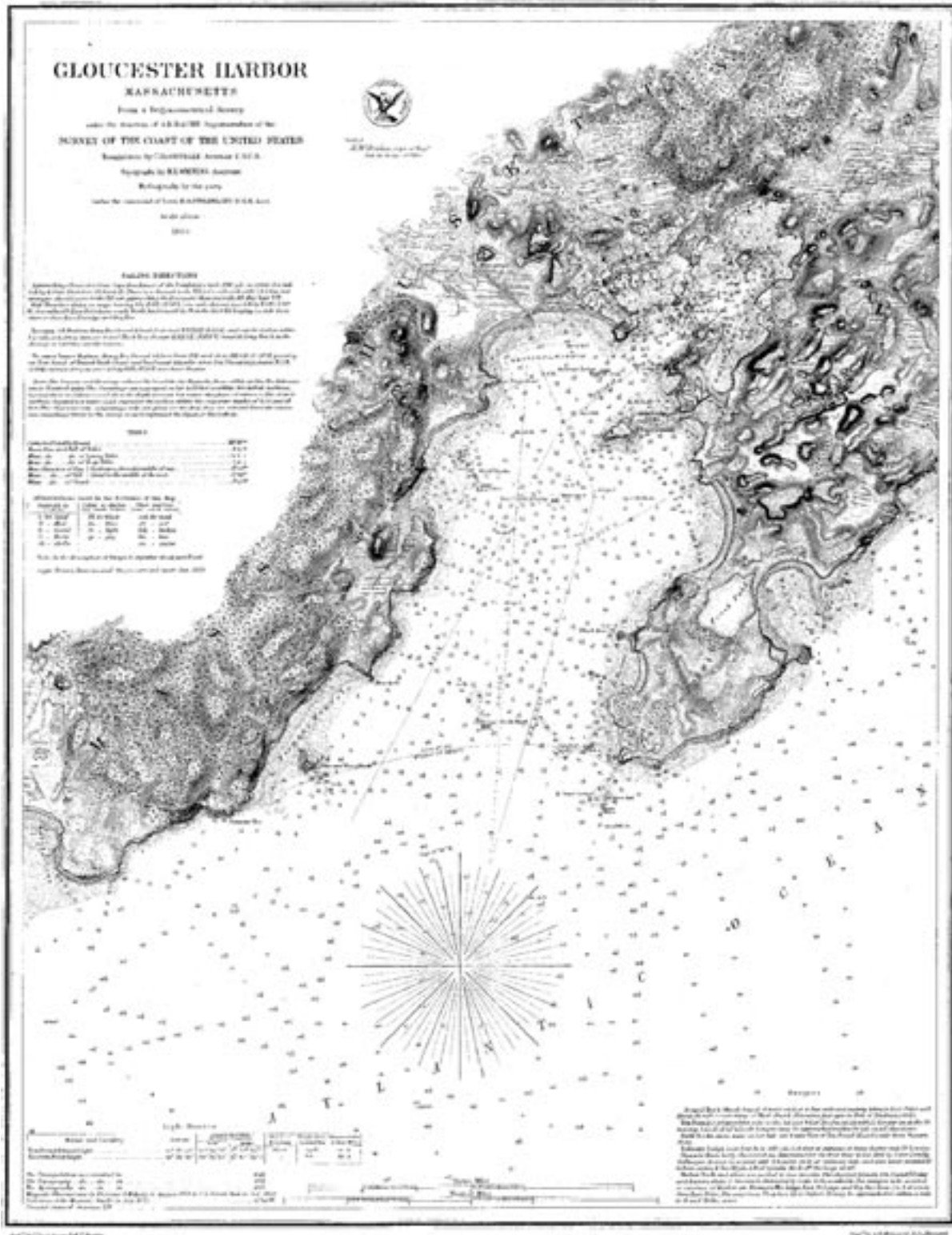
fisheries declined in the beginning of the 20<sup>th</sup> century. The use of steam and internal combustion engines, increased foreign competition, and changing target species decreased fishery productivity and affected Gloucester's economy.

By World War I (1914-1918), steam and internal combustion engines ultimately replaced wind vessels, weakening Gloucester's geographic advantage over Boston. Fishing practices also dramatically changed with the advent of diesel-powered boats. Diesel-powered boats towed nets through the water and efficiently caught haddock. Haddock replaced cod as the popular fresh fish (Garland 1972). Foreign fishing fleets were harvesting large volumes of cod and saturated the market with cod, substantially decreasing prices for salt cod. The Gloucester fleet was slow to modernize and adapt to changing economics and fishery situations. The port, for a period, lost a considerable volume of the fresh fish landings sold in Boston. Gloucester, however, developed fish processing infrastructure, marketing networks, and skilled labor, which helped retain its share of the market. Local entrepreneurs commenced national markets for new seafood products, including canned chowder, pet food, and processed mackerel, to replace lost economic activity (National Park Service 1994).

**Physical Changes and Shoreline Development**  
Public policy supported private construction on tidelands to encourage the growth of maritime industry. Chapter 279 of the Massachusetts Acts of 1867 authorized all persons owning flats in Gloucester Harbor to "extend and maintain wharves upon the same, or to fill up and build upon the same, but not beyond the harbor lines there now established" (Matchak 1989). This law reflected the view of the harbor as an economic resource, but also recognized the need to establish limits of seaward development to protect navigation.

Roger's Street—along the inner harbor—was constructed on fill between 1854 and 1865, creating a new coastal road with wharves and piers immediately abutting. Harbor Cove was shallow and larger ships could not access docks, making the practice of building out to reach deep water less practical (Matchak 1989). The 1855 map (Figure 1.1) provided a picture of the harbor before several major changes to the inner harbor. The federal government realized





**FIGURE 1.1** 1855 map of Gloucester Harbor. From the Image Archives of the Historical Map & Chart Collection. Office of Coast Survey/National Ocean Service/NOAA.

that investment to harbor infrastructure was required to maintain safe and navigable harbors and dredging became economically viable after the Civil War (1865). Key dredging technologies, such as steam engines, hydraulic pumps, and underwater explosives, were developed which initiated a history of federal investment for navigation improvements. The U.S. Army Corps of Engineers studied water depth of the inner and outer harbor in 1870, and ledge removal and dredging occurred between 1873 and 1890 throughout the harbor (USACE 1995). The Rivers and Harbors Act of 1892 authorized federal improvements to navigable waters, including Gloucester Harbor, and led to the examination of the inner harbor navigation infrastructure and Vincent's Cove. Vincent's Cove was determined too small to warrant further federal investment in dredging and was eventually filled. Navigation channels were delineated and dredged in the inner harbor to provide deep water for safe navigation in Gloucester Harbor (USACE 1995).

Dog Bar Breakwater was constructed between 1894 and 1904 by the Army Corps of Engineers to provide sheltered waters in the outer harbor. The breakwater protects outer harbor waters from southerly storms. The breakwater is 2,250 feet, running west from Eastern Point toward the western shore (USACE 1995).

### Modernization and Transition 1920 – 2000

New fishing technologies, increased harvest effort, and foreign competition impacted fish stocks and Gloucester's standing as a fresh fish port. Innovative processing technologies presented new opportunities for the fishing industry, and maritime business continued to diversify. Frozen fish was imported for processing and dominated fish handling in the local economy. Public policy shifted from unchecked exploitation of natural resources to sustainable use and environmental restoration. Dredging, filling, and waste disposal became heavily regulated, and environmental quality of the harbor was recognized as an economic asset for tourism and recreation.

#### Social and Economic Development

The early 1930s and the onset of the Depression were distinguished by dramatic decreases in the fishing fleet, volume of fish landed, and number of

people employed in Gloucester's fisheries. Fortunes improved with the development of a new method for filleting redfish. Redfish became a target species because of the similarity to freshwater perch and the huge market in Midwestern United States. Redfish was traditionally discarded as a trash species, but by 1943 Gloucester surpassed Boston in volume of fresh fish landed and exceeded all New England ports as a seafood producer. At this time, an estimated 70 percent of Gloucester's population depended on fishing (Haberland 1946). The success was relatively short-lived, however, because the slow growing redfish stock was quickly overfished and could not sustain the market by the late 1950s.

The processing and harvesting sector began to diverge during the early-to-mid 1900s. In 1929, Gloucester businessman Clarence Birdseye invented quick-freeze technology which maintained the appearance and quality of fresh fish. The technology inspired the next stage of fish processing, which was less dependent on local catch. Local vessels could not supply an adequate volume of fresh fish to processing plants, so fish was imported from other sources. The Gloucester fishing-related industry continued to shift from locally landed fish to processing imported fillets (National Park Service 1994). Landings continued to decline through the 1960s and 1970s, and the processing of imported frozen fish was Gloucester's most important industry.

Foreign competition and overfishing was a problem in the 1970s. Foreign fleets were equipped with new fishing vessels, navigational electronics, and fish detection equipment. These fleets traveled longer distances than U.S. vessels and took huge quantities of groundfish from domestic waters. Groundfish stocks (e.g., cod and flounder) declined by almost 70 percent between 1963 and 1974 (NMFS 1998). Gloucester fishermen could not afford to take advantage of new technologies because the U.S. fishing industry was limited under federal law to buy U.S.-built boats, which were more expensive than boats built overseas. Foreign fishing and decimated fish stocks hindered the economy of New England fisheries, particularly in Gloucester.

The Magnuson-Stevens Fisheries Conservation Act (1976) (Magnuson-Stevens Act) ended competition from foreign fishing fleets in domestic waters

by establishing the 200-mile U.S. territorial sea (i.e., Exclusive Economic Zone [EEZ]). Foreign vessels were excluded from the EEZ, and U.S. fishermen were sole proprietors of EEZ fishery resources. The Magnuson-Stevens Act encouraged domestic investment—supported by federal loan and tax incentives—that provided larger, technologically sophisticated vessels with greater and more efficient harvesting capacity.

Groundfish landings dramatically increased with the elimination of foreign pressure, and Gloucester landed the most fish in the Northeast United States (Mason personal communication). Fish populations could not sustain the effort, and peak landings in 1978 were followed by sharp population declines to record low levels by the early 1990s (NMFS 1998). Subsequent management restrictions, over the past two decades, decreased groundfish landings to half of port revenues (Kearney 1994).

#### Physical Changes and Shoreline Development

The filling of intertidal and submerged lands to create the State Fish Pier and Vincent's Cove completed the harbor's contemporary shoreline. The State Fish Pier, encompassing 12 acres, was constructed in 1938 to accommodate businesses in the seafood industry. Pier construction filled the shallow area at the Head of the Harbor, extending a 380-foot-wide pier from land approximately 1,100 feet into the harbor, covering Fivepound Island. The State Pier expanded 100 square feet in 1989. In 1962, the Gloucester Housing Authority (GHA)—the local urban renewal agency—designated an urban renewal area extending from Harbor Cove to the State Fish Pier. The preparation of these urban renewal parcels included the virtual elimination of Vincent's Cove and constituted the last major fill project in Gloucester Harbor (GHA 1971).

The urban renewal and State Pier project, extension of highway access (Route 128) to Gloucester, and construction of a fixed-span bridge over Blynman Canal in the 1950s paralleled a regional shift from trains to trucks for freight handling. The waterfront changed to meet the demands of the new transportation system. The city received federal funding to overhaul sections of the inner harbor. The redevelopment included acquiring and creating large development parcels, clearing buildings, widening

Rogers Street, and replacing pile supported finger piers with bulkhead and wharves. The project created a working waterfront that accommodated freighters and truck traffic.

#### Wastewater Management

There was no centralized sewage collection system in Gloucester before 1928. Industrial and residential wastes were directly discharged into waterways. The original sewage interceptor system was constructed over a 20-year period and included eight miles of combined sewers, fifteen miles of sanitary sewers, and numerous private and combined sewers in the downtown area (Whitman and Howard 1958). This infrastructure served as the wastewater management system for downtown Gloucester, and wastes were discharged to the outer harbor. The original wastewater system did not include all developed areas. A 1967 survey found 129 pipes discharging into the waters of Gloucester Harbor and Annisquam River, including 84 pipes releasing raw sewage (Jerome et al. 1969).

The Gloucester Water Pollution Control Facility (WPFC) began operation in 1984 and advanced wastewater management in Gloucester. This plant performed primary treatment (e.g., solids and sludge removed from wastewater), and the treated waste was initially discharged to the outer harbor. The outfall was extended southwest of Dog Bar Breakwater in 1991 to eliminate discharge directly to the harbor, and a chemical enhanced treatment process (i.e., ferris chloride added to settle small solids) started in 1993. Through the 1990s, the sewerage system was constructed for most of Gloucester. There are currently areas of Gloucester that are not part of the sewer system. These areas are reliant on residential septic systems for small-scale wastewater treatment.

## CURRENT HARBOR CHARACTERISTICS

Despite recent declines in the fishing industry and a broadening local economy, the harbor is the defining component of Gloucester's character and remains a key asset and the primary economic force in the community. Gloucester's population is currently 29,000 and has not substantially fluctuated during the past century (Pringle 1892; US Census Bureau 1995) (Figure 1.2). The population slightly increased over the last several decades, and the summer population



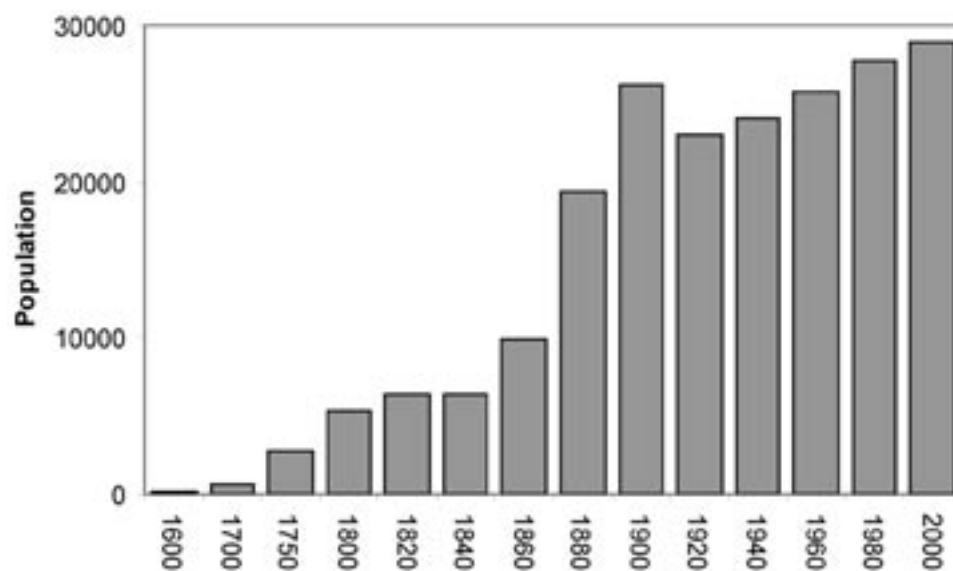


FIGURE 1.2 Human population for the City of Gloucester (US Census Bureau 2000).



FIGURE 1.3 Color orthophotograph of Gloucester Harbor (1:5,000m; MassGIS 2001a).



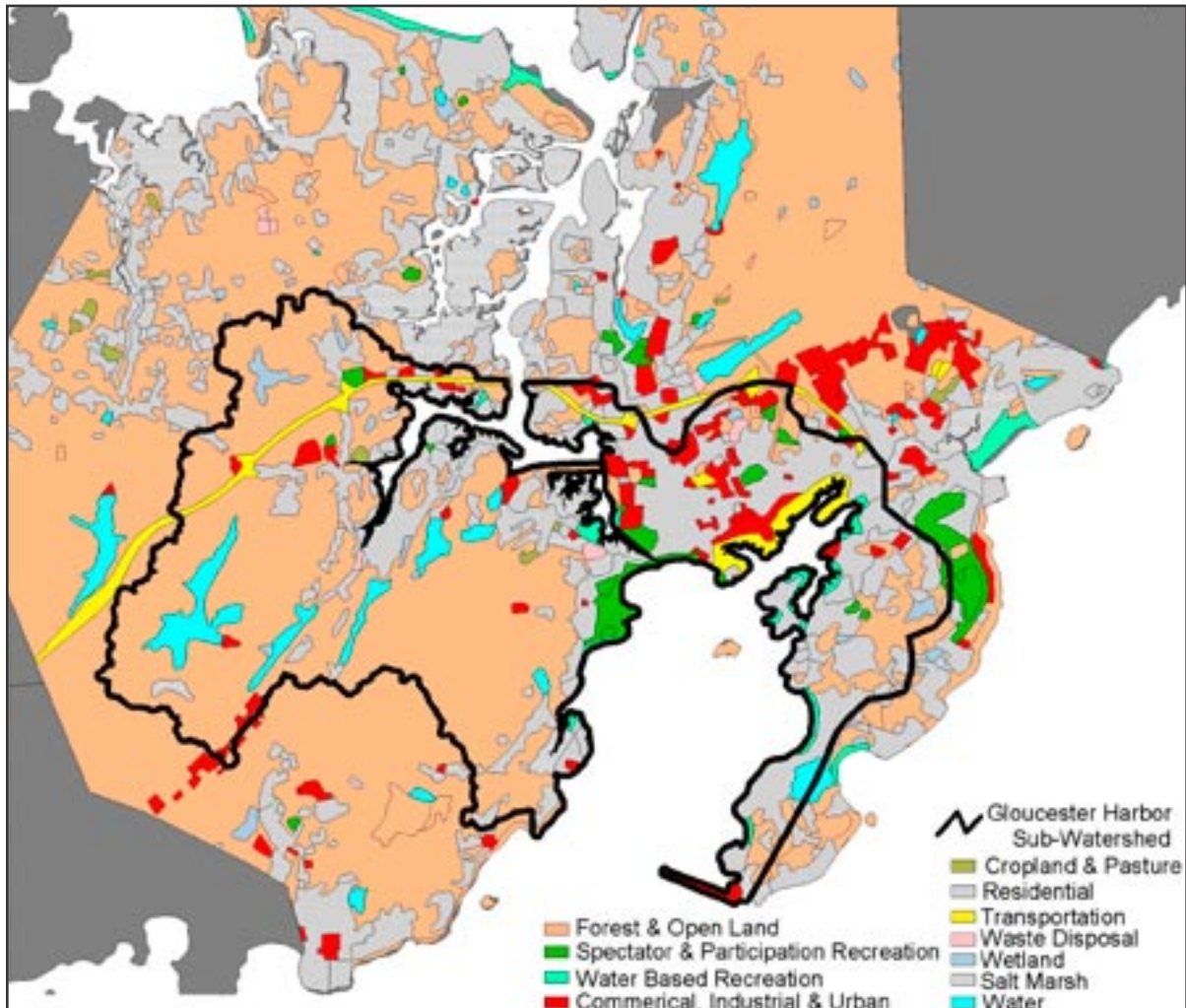


FIGURE 1.4 Land-use (MassGIS 2001b) in City of Gloucester and Gloucester sub-watershed (Buchsbbaum personal communication).

is considerably larger (City of Gloucester 1993). The population is distributed throughout Gloucester and heaviest around the inner harbor (Figure 1.3).

The area surrounding the inner harbor, including the working waterfront and downtown business center, is a densely populated urban core. The majority of industrial activity is located on the inner harbor and industrial parks (i.e., Blackburn Industrial Park on Blackburn Circle, Kettle Cove Industrial Park on Western Avenue, and Cape Ann Industrial Park on Magnolia Avenue). Commercial operation surrounds the central business district which is located northwest of the harbor. The high-density residential zone is also concentrated around the downtown and west side of the harbor.

Gloucester as a whole is dominated by undeveloped land (i.e., open land and forest, 58%) and protected through public ownership (Figure 1.4) (MPC 1998; MassGIS 2001b). Residential land constitutes a considerable portion (24 percent) of Gloucester (MPC 1998). Outside the downtown area, rural residential and medium density villages reflect historic development patterns that centralized activity along the city's 64-mile coastline and tidal waterways (City of Gloucester 1993). Commercial and industrial land represents less than 2 percent of the city's land area. East Gloucester and the area southwest of Blynman Canal is medium-density residential. Current development is proposed in outlying residential areas and on vacant lots downtown (Cleaves personal communication).

### Economic Features

Gloucester's business profile has diversified, including high technology, light industrial, and tourism sectors. A large portion of residents (~52 percent) commute out of the city to work (Cleaves personal communication). Despite economic change, the fishing and traditional maritime industries remain an important part of local economics, and waterfront-related visitor and recreational services continue to expand. The Gloucester Harbor Plan (1999) describes Gloucester Harbor as a mixed-use port, with expanding fisheries-related and tourism businesses. Maritime industry (e.g., fresh fish, frozen fish processing, vessel support services, and waterfront tourism) currently provides important local employment and revenue (ICON 1999).

Fisheries continue to evolve despite lower landings, changing target species, and management restrictions. Traditional harvesting sectors, such as groundfishing, are important to Gloucester's fishing industry, but specialized niche markets and quality marketing, such as live fish, are supplementing traditional fisheries. Lobster is the most productive fishery in Gloucester (Pava et al. 1998), and 218 lobster boats berth in Gloucester Harbor (1998).

Three vessel classes fish from the port, including day boats, offshore draggers, and transient vessels. Small day boats (under 75 feet) fish inshore and seasonally target different species, such as specialty export markets for sea urchins, hagfish, and dogfish. There are twelve offshore draggers (larger than 75 feet) that fish year-round on multi-day trips and are primarily groundfish boats. Numerous transient vessels fish out of Gloucester, including tuna, swordfish, and herring boats (ICON 1999).

Recreational fishing, including individual sport boats and charter vessels, tremendously expanded in the last 50 years (USDOC 1975; NMFS 1998). Seventeen sport fishing boats (i.e., charter and party) harbor in Gloucester, ranging from 19 to 100 feet. There are nine party boats (65-100 feet) working from Gloucester Harbor (MDMF 2001). There are approximately 2,100 recreational vessels registered in Gloucester, and many of these engage in fishing (Tulik personal communication). Shore-side angling is also popular in the outer harbor, particularly along Dog Bar Breakwater.



**FIGURE 1.5** Generalized mooring areas in Gloucester Harbor and Annisquam River. Moorings are found throughout the Annisquam River and are organized by area (Caulket personal communication).

Non-traditional maritime activities are a growing component of waterfront economics. There are whale watch operations, fishing charters, harbor tour boats, the Gloucester to Provincetown ferry, and excursions operating between Gloucester, Salem, and Boston. Cruise companies occasionally use Gloucester as a port-of-call, anchoring in the outer harbor and shuttling passengers shore-side for day trips. In 1999, Gloucester hosted the first gambling cruise in the Commonwealth. The specific operations are highly changeable, and visitor accommodations on the water are an expanding market that is attracting investment (ICON 1999).

### Shoreline Infrastructure and Navigation

There is an estimated 13,195 linear feet of commercial wharves and piers on the inner harbor that can accommodate 76 commercial vessels, ranging in size from 20 to 60 feet. The State Fish Pier has dockage for 17 larger fishing vessels (over 60 feet) and berths for 43 smaller (30-40 feet) vessels (Urban Harbors Institute 1994). The city manages two facilities for commercial fishing boats, providing 24 berths for vessels from 25 to 45 feet. The outer harbor mooring is available for larger, transient vessels.

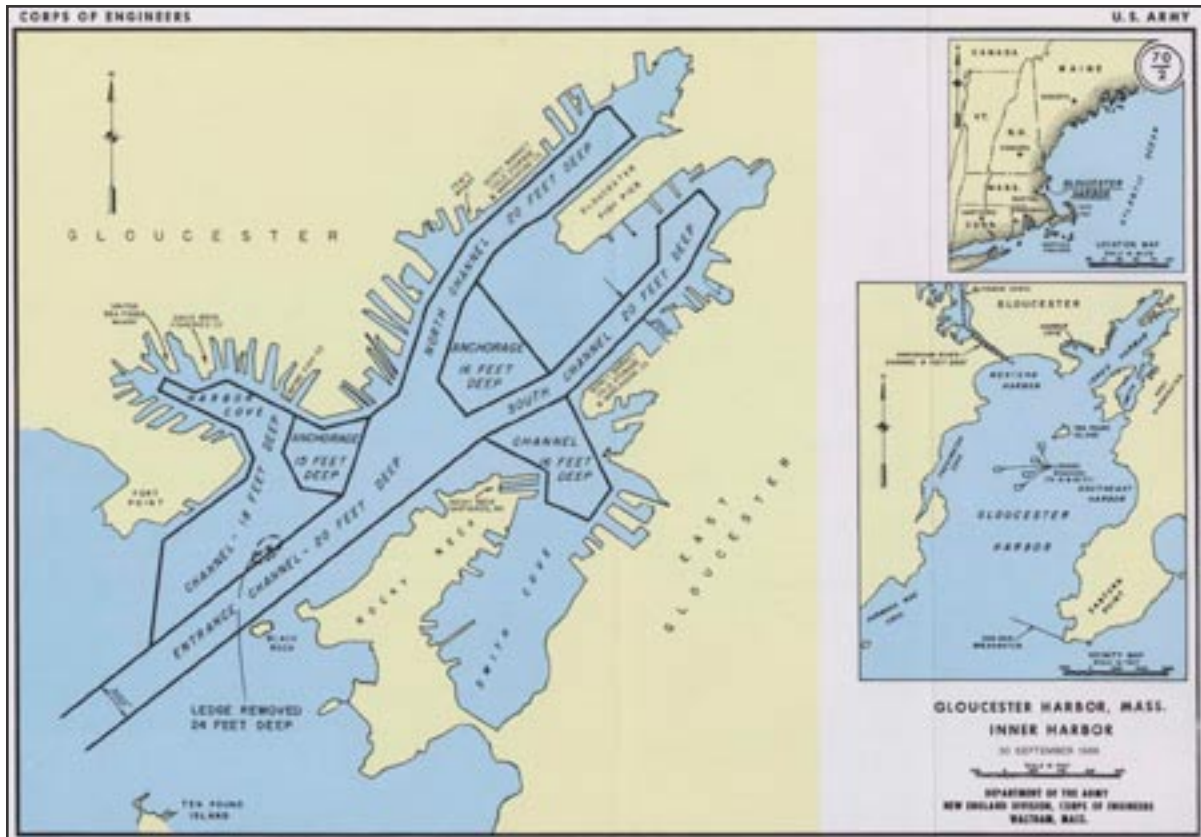


FIGURE 1.6 Federal navigation channels and anchorage areas in Gloucester Harbor (USACE 1995).

Seven recreational marinas and a yacht club provide services and facilities for recreational boaters on the east side of the harbor, including Smith Cove and Eastern Point. Gloucester's Harbormaster manages 1,168 private moorings; 376 located in the inner and outer harbor and 742 on the Annisquam River and Lobster Cove (Figure 1.5). The majority of the moorings accommodate recreational vessels. Twenty-five transient moorings accommodate visiting boaters. There are 25 public landings in Gloucester, ranging from a major boat launching facility at Dunfudgin Landing located on the Annisquam River to small, undeveloped access points that are useable only during certain tides (e.g., Lanes Cove). The smaller landings are important access points for commercial clambers, using skiffs to reach the clam-flats in the Annisquam River. New floats, dinghy docks, and long- and short-term tie-up opportunities were recently obtained in the inner harbor (i.e., Cripple Cove and Solomon Jacobs Landings; Caulkett personal communication).

The U.S. Army Corps of Engineers maintains federal

navigation channels, turning areas, and anchorages (Figure 1.6). The navigation channels include the 300-foot wide main channel running from the outer harbor to inner harbor and two 200-foot wide branch channels in the inner harbor (North and South Channels). There are turning areas in the inner harbor and anchorages at Fort Point-Harbor Cove, Harbor Cove, two State Pier anchorage areas, lower Smith Cove, and Annisquam River (Figure 1.6). Adjacent to the federal channels, many privately owned maritime facilities maintain navigation into the facilities. The Corps also maintains Dog Bar Breakwater and Blynman Canal.

The Blynman Canal allows efficient north-south passage between Ipswich Bay and Gloucester Harbor, avoiding the open ocean route around Cape Ann. The drawbridge was electrified and the canal initially dredged by the state in 1907. The Annisquam River is one of the busiest stretches of water in New England (Duncan and Ware 1987), and the navigation channel is managed by the Army Corps of Engineers. The canal and drawbridge is maintained by the Mas-



sachusetts Department of Environmental Management (DEM) and is under Massachusetts Highway Department (MHD) jurisdiction.

**Wastewater and Stormwater Management**  
Wastewater treatment began in 1984 with the construction of the WPCF. The plant has a design flow of 7.2 million gallons per day and discharges approximately five million gallons of treated effluent per day through a 36-inch outfall south of Dog Bar Breakwater. Gloucester is one of 45 communities nationwide, and the only one in Massachusetts, with a waiver of the Clean Water Act requirement (section 301[h]) to provide secondary or biological treatment for wastewater before discharge. The 301(h) waiver required the treatment plant to institute an industrial pre-treatment program that sets specific local limits for the 20 industrial users, of which 16 industrial users are fish processing operations (Millhouse personal communication). Oil and grease violations were a problem during the first few years of treatment plant operation, so an enhanced primary treatment process was instituted in 1993. The enhanced process improved oil and grease removal and reduced biological oxygen demand and total suspended solids.

Stormwater (i.e., surface runoff due to precipitation) drains to the harbor through two conveyance systems: 1) combined sewers and 2) direct stormwater discharges. Combined sewers carry sanitary sewage and stormwater to the WPCF. A mixture of stormwater and sewage are discharged to the harbor through combined sewer overflows (CSOs) when the capacity of the wastewater system is exceeded. Stormwater overflows collect surface water, such as rain, and discharge into the harbor during every rain event. Run-off from roads, parking lots, roofs, and cultivated land also directly contributes an uncertain volume of stormwater to harbor waters.

There are six CSOs located around the harbor. Four of the CSOs periodically discharge in response to storm events, and the remaining two discharge only under extreme conditions (e.g., excessive rains that cause a flood). The CSO system receives stormwater from approximately 375 acres through 2,500 catch basins, annually discharging approximately 26 million gallons (Metcalf and Eddy 1992). The CSO found on Pavilion Beach discharges 80% of the total

CSO volume (Metcalf and Eddy 1992). Stormwater directly enters inner and outer harbor waters through 17 storm drains, contributing 575 million gallons of effluent to the harbor (Metcalf and Eddy 1992).

## **SUMMARY**

Gloucester Harbor is an important resource for the Commonwealth of Massachusetts. The harbor provides a major center for the fishing industry, maritime business, and future opportunities to expand marine-based uses. The harbor has drastically changed since European colonization to support the working waterfront. Coastal development, dredging and filling, and increased human population altered the shape of the harbor. The fishing industry remains an important component of Gloucester Harbor. The fisheries, including target species and fishing practices, changed through time, but the economy and society of Gloucester endure these changes. Environmental quality was largely unchecked until the mid-to-late 1900s, and long-term effects of pollution entering the harbor and the development of Gloucester are largely unknown. Gloucester's economy and environment weathered many challenges through the development of this protected embayment of Cape Ann into a productive maritime port.

## **ACKNOWLEDGMENTS**

This study was funded by the Massachusetts Office of Coastal Zone Management Grant. Fara Courtney (Good Harbor Consulting) spent hours with Gloucester officials and staff searching for historic records. CZM staff, particularly thank you to Anne Donovan, reviewed earlier versions of the report.

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